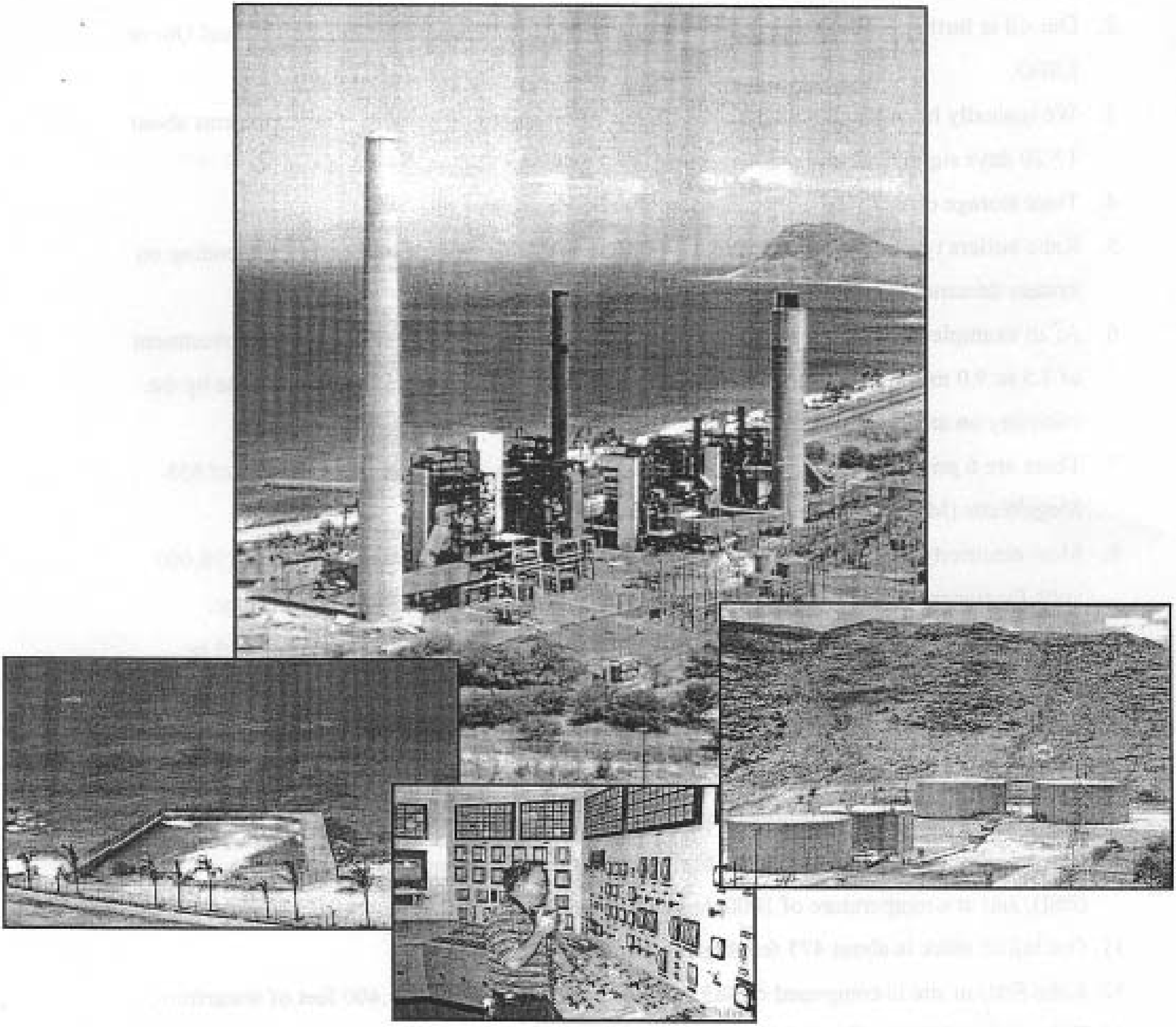
Welcome!



To Kahe Power Plant

Hawaiian Electric Co., Inc.

Kahe Station Facts Sheet

1. All units at Kahe Station are fueled by No. 6 heavy oil. This oil is often referred to as residual oil, because it is comprised of what is left from the refining process after the lighter fuels have been distilled.
2. Our oil is further processed to remove sulfur, and is therefore called Low Sulfur Fuel Oil, or LSFO.
3. We typically have 250,000 to 300,000 barrels of oil stored on station. This represents about 17-20 days supply. A barrel of oil contains 42 gallons.
4. Total storage capacity on station is about 490,000 barrels of oil.
5. Kahe boilers typically consume about 14,000 to 21,000 barrels of oil per day, depending on system demand.
6. At an example market fuel price of $30./barrel, this fuel inventory represents an investment of 7.5 to 9.0 million dollars. Fuel is the single most expensive commodity purchase by the company on an annual basis.
7. There are 6 primary generating units at Kahe Station, having a combined capacity of 635 MegaWatts (MW).
8. Most electricity leaving Kahe station for distribution across the island is raised to 138,000 volts for transmission. Some areas are supplied using a 43,000 transmission voltage.
9. Our generating units at Kahe are all steam turbine powered. Our units are classified as "Reheat" units because we use the steam in part of our turbines, send the steam back to our boilers to be reheated, and then return it to the turbines to complete the cycle. This process increases our unit efficiencies dramatically, saving on fuel consumption over "Non Reheat" units. Our largest turbine produces about 190,000 horsepower.
10. Steam is delivered by our boilers to our turbines at a pressure of 1800 Pounds / Square Inch (PSI), and at a temperature of 1000 degrees Fahrenheit.
11. Our tallest stack is about 475 feet high.
12. Kahe Station site is comprised of 485 acres of land, and has about 4,400 feet of waterfront.
13. Kahe station has two General Motors EMD diesel generators, each having a capacity of 2.4 MW, and are used to provide startup power for our steam units in the even all units have tripped off line and there is no other power source on the island.
14. Typically, a crew of no less than 11 Plant Operators staff our generating units 24 hours a day, 7 days a week.

POWER PLANT CYCLE – MAJOR COMPONENTS

The letter designations below refer to those on drawing entitled "SIMPLIFIED POWERPLANT DRAWING", which outlines the workings of our "Energy Conversion" process.

A - Chemical energy is stored in the form of "Fuel Oil" which is maintained on the station in large quantities inside steel tanks. These tanks are designed to safely contain the oil and to keep it hot enough to allow pumping or gravity flow to the various generating units. The fuel oil tanks are surrounded by concrete or earthen dams called berms, which are designed to contain the entire contents of a full tank if there were a major rupture or leak in the tank wall.

B - Pumps called "Primary Fuel Oil Pumps", located on the fuel oil supply header, raise the pressure of the oil to 50 to 100 pounds per square inch (PSI).

C - Another pump called the "Secondary Fuel Oil Pump" takes the 50 - 100 PSI from the discharge of the primary pump and further raises the pressure of the fuel oil to 450 PSI, and in some cases 1000 PSI. The fuel oil temperature is raised in the fuel oil heater on the way to the burners.

D - The "Burners" convert the chemical energy of the fuel to heat energy in the "Furnace" section of the boiler.

E - The boiler water wall tubes absorb the heat energy, converting the water in the tubes to steam. The steam collects in the "Drum" at the top of the boiler.

F - Air needed to burn the fuel oil in the boiler furnace is supplied by "Forced Draft Fans". Oxygen is needed in exact quantities to burn all of the fuel. Since only 21% of the air is oxygen, large amounts of air must be delivered to the furnace by the fans. About 77% of the air is nitrogen, which does not take part in the combustion process, but passes through the boiler anyway. Some heat energy is lost to warming the nitrogen as it passes through.

G - Hot combustion gases (CO2, water vapor, and lots of nitrogen) leave the boiler through the "Stack". Monitoring instruments give operators indication in the control room of what is coming out the stack.

H - Steam from the boiler is delivered through piping to the "High Pressure Turbine". Here, some of the heat energy of the steam is converted into rotating mechanical energy. On some generating units, steam leaving the high-pressure turbine (called "Cold Reheat") returns to the boiler to be reheated. The steam (now Hot Reheat) then goes back to the "Intermediate Turbine" where additional heat energy is converted to rotating mechanical energy. The generating turbine of this type is called a <u>reheat</u> unit, and represents our most fuel efficient unit design.

I - On all units, steam leaving the intermediate or high-pressure turbine now enters the "Low Pressure Turbine". This is the final step in converting the energy of the steam to rotating mechanical energy.

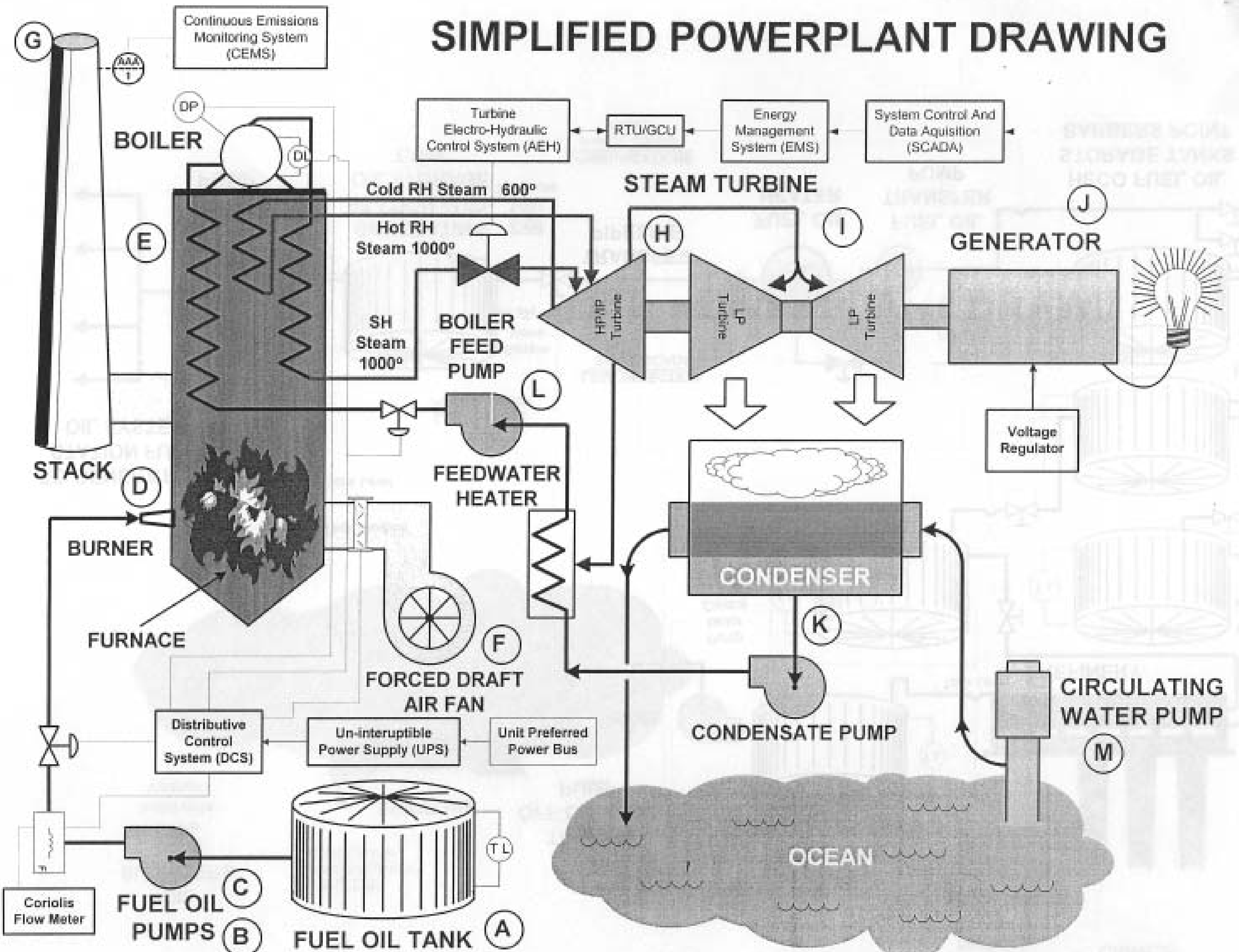
J - The rotating mechanical energy of the turbine is converted into electrical energy in the "Generator".

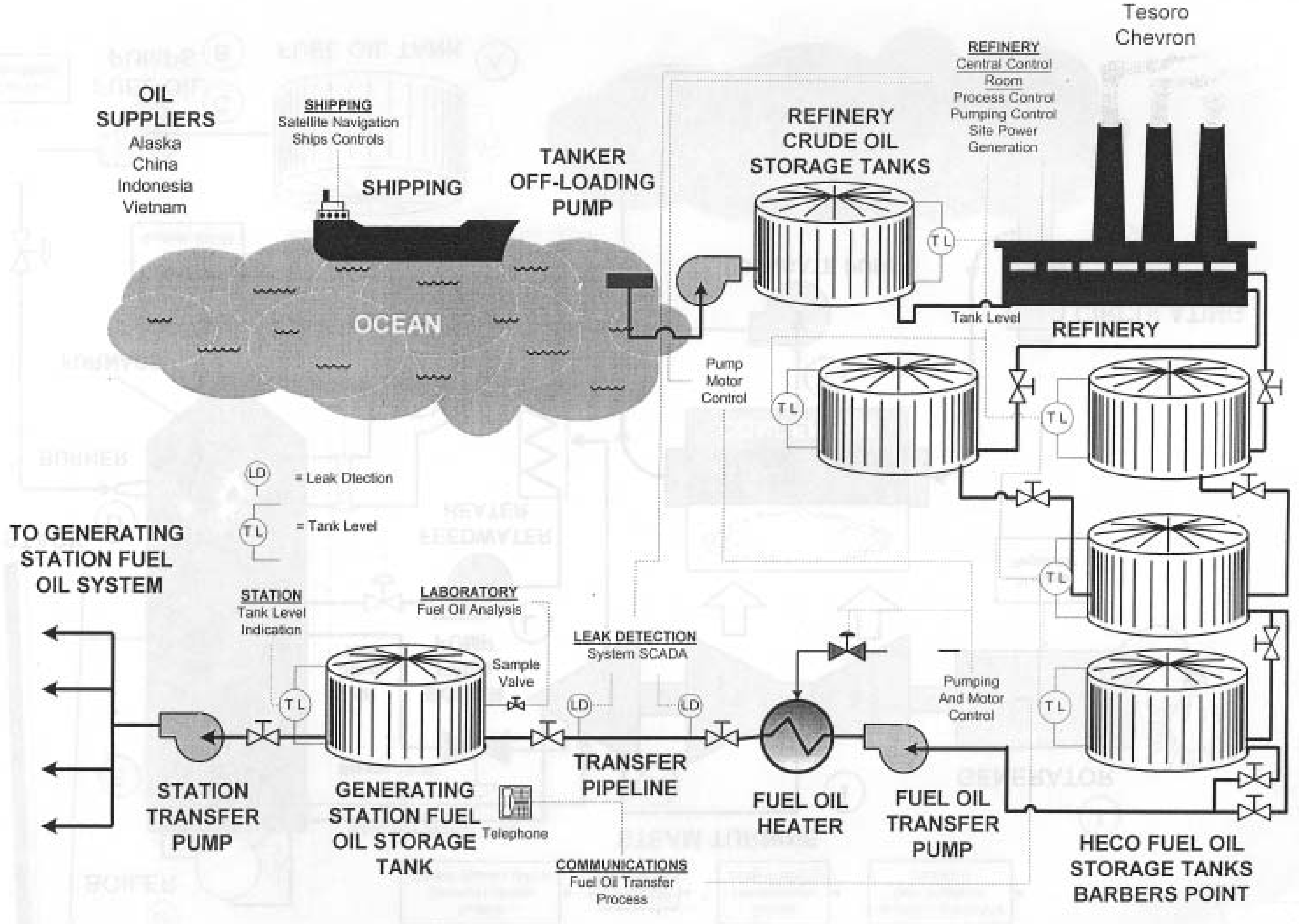
K - Steam leaving the low-pressure turbine enters the "Condenser", where the remaining heat energy is extracted. This causes the steam to condense back into water. The condensed water can then be pumped out of the condenser "hot-well" by the "Condensate Pump", to begin its return trip to the boiler, where it will converted into steam again.

L - Steam condensed back into water is delivered by the condensate pumps to the "Boiler Feedwater Pumps". The boiler feedwater pump takes the discharge water from condensate pump (K) and raises its pressure to 2500 – 3000 PSIG to force water back into the drum. This function is critical to the continuous operation of the boiler, since the amount of water in the boiler will go down as steam is produced and sent to the turbine. For the boiler to operate, the water turned into steam must be replaced on a continuous basis.

M - Cooling water delivered to the condenser by the "Circulating Water Pumps" is used to extract the remaining heat energy from the low-pressure turbine exhaust steam so it can be converted back into water, and start its trip back to the boiler to be used over again. The source of cooling water for the condenser may be the ocean, a river, or a harbor.

SIMPLIFIED POWERPLANT DRAWING

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China
Indonesia
Vietnam
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Satellite Navigation
Ships Controls
SHIPPING
TANKER OFF-LOADING PUMP
OCEAN
REFINERY CRUDE OIL STORAGE TANKS
REFINERY
Central Control Room
Process Control
Pumping Control
Site Power Generation
Tesoro
Chevron
Tank Level
REFINERY
Pump Motor Control
LD = Leak Dlection
TL = Tank Level
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STATION
Tank Level Indication
LABORATORY
Fuel Oil Analysis
Sample Valve
LEAK DETECTION
System SCADA
Pumping And Motor Control
STATION TRANSFER PUMP
GENERATING STATION FUEL OIL STORAGE TANK
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